be true, there is inconsistency in some questions in the first lessons; for example: "Is there evidence that Paramœcia can breathe?" "Has the Amœba a stomach?" Such questions are meaningless unless the pupil has some scientific knowledge of structure and functions in higher forms.

On the whole, the spirit and plan of most of the lessons may be commended. Many teachers will welcome this as a laboratory guide which aims to meet the popular demand for less study of comparative anatomy and more about animal life in secondary education.

M. A. B.

Human Physiology. — Dr. Wm. D. Zoethout's translation of Schenck and Gürber's *Human Physiology*[1] places within reach of the English-reading student one of the best of the shorter German physiologies. The translation is from the second German edition and follows the original closely. After a brief introduction on general physiology, the subject-matter is arranged under three heads — metabolism, the transformation and setting free of energy, and reproduction and development. The treatment is as modern as is consistent with general soundness. Thus we are told that "a solution tastes the more sour the greater the number of hydrogen atoms replaceable by metals contained in the unit of volume," a statement which includes all that is up to date without involving the reader in the dissociation hypothesis. Although the text of the book has been compiled with great conciseness and care, it is to be regretted that the illustrations are so inadequate. Thus the figure showing the general anatomy of the ear as copied from Helmholtz, and the positively inaccurate drawing of the cross-section of the lamina spiralis membranacea are scarcely justifiable. Nor is there good reason why the olfactory epithelium should be illustrated by a figure from Max Schultze, when such work as that done by Retzius, Van Gehuchten, and others is so readily accessible. Such defects, however, are small compared with the merits of the volume, which should be in the hands of every medical student and every teacher of elementary physiology.

P.

Korschelt and Heider's Embryology of Invertebrates. The fourth part of the English edition of Korschelt and Heider's *Ent-*

[1] Schenck, F., and Gürber, A. *Outlines of Human Physiology.* Translated from the second German edition by Wm. D. Zoethout. New York, Henry Holt & Co., 1900. viii + 339 pp.

wicklungsgeschichte der wirbellosen Thiere completes the translation of this monumental work.[1] As in the second and third parts, the translation has been done by Matilda Bernard, and the revision and editing by Martin F. Woodward. The present part gives an account of the embryology of the mollusks, the tunicates, and Amphioxus, and in the groups covered agrees with the third part of the German edition except in the omission of the chapters on the brachiopods and the Bryozoa, which the translators had previously placed in their second part. The third part of the German edition appeared in 1893; the translation, therefore, is unfortunately some seven years late. This has put on the editor the heavy task of supplying the more recently acquired information on the groups under consideration. Mr. Woodward has wisely refrained from rewriting the third portion of the work, and has attempted to bring it up to date by employing footnotes and adding to the literature lists, as in the former part. While this is perhaps the best way out of the difficulty, it does not seem to have been employed very successfully in this last part. As an example, the chapter on Amphioxus may be cited. Our advance in the knowledge of the embryology of this form is indicated in some seven notes, none of which give very extensive information. The appendix to literature for this chapter contains some fifteen new titles. As these presumably cover the period from 1893 to 1900, the list is obviously incomplete. One misses any reference to Lwoff's completed paper on the germ layers (1894), Legros's note on the morphology of the sexual glands (1895), MacBride's note on germ layers (1896), Garbowski's discussion of the mesoderm (1898), Klaatsch's account of the structure and development of the tentacles (1898), Lankester's note on the development of the atrial chamber (1898), and Legros's description of the development of the buccal cavity (1898), contributions which, judging from the composition of the literature lists in the German edition, should have been recorded. Incidentally it may be mentioned that of the names given in this appendix Hamman is substituted for Hammar and the capitalization of MacBride is unsteady. On the whole, the additions made by the editor do not show the high standard of work characteristic of the German original. The presswork, particularly in connection with the illustrations, retains more or less of the muddiness of the earlier parts. Notwithstanding these shortcomings,

[1] Korschelt, E., and Heider, K. *Text-Book of the Embryology of Invertebrates*, vol. iv. Translated by Matilda Bernard, revised and edited by Martin F. Woodward. New York, The Macmillan Company, 1900. xii + 594 pp., 312 figs.

the translation is generally so well done that the work, now that it is completed, cannot but be a boon to the English-reading student.

P.

Heart-Beats in Salpa. — The pulsation of the heart in three species of Mediterranean Salpas has been exhaustively studied by L. S. Schultze.[1] As is well known, the hearts of these animals beat first in one direction and then in the other. A complete set of *advisceral* or of *abvisceral* beats constitutes a *pulsation series*. The intervals between pulsation series are known as *pauses*. An advisceral pulsation series and its pause, followed by an abvisceral series and its pause, form a *compound heart period*.

The numbers of beats in pulsation series were so extraordinarily variable that a normal number could not be found. The total number of abvisceral beats may be considerably more or less than that of the advisceral beats; thus in one case 247 abvisceral beats corresponded to 100 advisceral beats, and in another 237 abviscerals to 523 adviscerals. The rates of the two sets of beats were, however, very close; thus 100 abvisceral beats were accomplished in 175 seconds, and the same number of adviscerals in 174 seconds. As the water in which the animal was kept lost oxygen, the rate of beating increased; thus an individual's heart, which at the beginning of the experiment beat 100 times in 208 seconds, after six hours beat the same number of times in 148 seconds. Of the three species studied, the two larger ones, *Salpa africana-maxima* and *Cyclosalpa pinnata*, had an average rate of 26 to 30 beats per minute; the smaller, *Salpa democratica-mucronata*, 107 per minute. The pauses between ad- and abvisceral series varied from 1 to 4 or occasionally 5 seconds.

Each heart-beat is a peristaltic wave that sweeps over the heart from one end to the other. Usually a new wave appears at one end before the old one has passed off at the other, and sometimes as many as seven waves may be counted on a heart at once. Krukenberg believed that the two ends of the heart were physiologically very different, and that nicotine and hellebore affected the advisceral pulsations only, the former diminishing, the latter increasing them. Schultze, however, found that these poisons influence the ab- as well as the advisceral pulsations, and thus demonstrated that the ends of the heart were not in this respect dissimilar.

[1] Schultze, L. S. Untersuchungen über den Herzschlag der Salpen, *Jenaische Zeitschr. f. Naturwissenschaften*, Bd. xxxv (1901), pp. 221–328, Taf. IX–XI.